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14. ABSTRACT

The purpose of this report is to summarize briefly the history of the Surface Water Research project since its inception in 1952, the work accomplished, and the problems encountered. In general, each topic is discussed under two periods of timc: 1952-1963, when projects were confined to the Helmand River Valley and was entitled "Helmand Surface Water Investigations (306-12-021, 306-M-12-AD and 306-AC-12-AD5)," and 1963-1969 when activities were expanded to cover most of Afghanistan and title was changed to "Surface Water Research (306-11-190-002)".

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Appendix (11)

Reconnaissance Sediment Survey of Kajakai and Arghandab Reservoirs, Helmand River Basin, Afghanistan

By George Porterfield and A.O. Westfall
U.S. Geological Survey
May 1967

A reconnaissance survey of Kajakai and Arghandab Reservoirs was made May 26-28, 1967 to observe the present extent of silting and to determine the optimum method to be used for detailed sediment studies at each reservoir. This preliminary report is not complete, but is only intended to alert the US AID/Kabul to the magnitude of sedimentation observed during this survey. The optimum methods for detailed studies will be given in a later report.

Soundings of water depth at various points in the lake were made with a sonic depth recorder, and an attempt was made to measure sediment thickness at several points with a steel rod.

Arghandab Reservoir

Storage began in Arghandab Reservoir on February 24, 1952 and the initial storage capacity was 388,000 acre-feet. The daily mean inflow to the reservoir for the 17-year period, 1948-64, was 1,398 cubic feet per second (cfs). The annual runoff has varied from a maximum of 2,168,000 acre-feet in 1957 to a minimum of 464,100 acre feet in 1955. The average annual runoff for the period was 1,012,000 acre-feet. The maximum discharge recorded was 35,700 cfs on March 17, 1957 and the minimum recorded was 44 cfs on September 7-8, 1948.

The only major source of the sediment deposited in Arghandab Reservoir is that which is transported by the Arghandab River. Deposited sediment now fills the upper 3 miles of the reservoir where water depths were originally as much as 32 feet. Soundings also indicate sediment deposits up to 30 feet thick for an additional 2 miles of reservoir and up to 20 feet thick for one more mile. Although soundings were not taken in the lower part of the reservoir (the reservoir is approximately 10 miles long) silting has undoubtedly occurred.

A rough estimate based on the above observations indicates that up to 25 percent of the reservoir capacity has been lost to sedimentation in the last 15 years and that the present storage capacity of the reservoir is less than 300,000 acre-feet. If the past rate of sediment accumulation continues, the reservoir will probably be filled by sediment in another 45 years.

Kajakai Reservoir

Storage began in Kajakai Reservoir on January 28, 1953 and the initial capacity was 1,495,000 acre-feet. The daily mean inflow to the reservoir for the 17-year period, 1948-64, was 6,977 cfs. The annual runoff has varied from a maximum of 9,059,000 acre-feet in 1957 to a minimum of 3,175,000 acre-feet in 1962. The average annual runoff for the period was 5,051,000 acre-feet. The maximum peak discharge is unknown. The maximum mean daily discharge recorded was 66,200 cfs on May 3, 1957. The minimum discharge recorded was 1,100 cfs on October 1, 1947 (start of record - it may have been lower prior to that date).

The only major source of the sediment deposited in Kajakai Reservoir is that which is transported by the Helmand River. In the upper arm of the reservoir soundings indicate sediment deposits of up to 50 feet in thickness. Because of the size, shape, and operational pattern of the reservoir the distribution of sediment is not as readily determined as it is in Arghandab Reservoir. The narrow upper part of Kajakai Reservoir is not as completely filled as the upper part of Arghandab Reservoir because of the large volumes and high velocities of the water entering while the lake is filling. This moves sediment previously deposited much further into the reservoir. The large upper arm of the lake will trap much of the sediment while lake levels are high, but at the start of the storm season when lake levels are low the sediment will pass through the upper arm and into the main body of the lake.

Although the silting of Kajakai Reservoir is not as obvious to the eye as that of Arghandab Reservoir the facts point to a rate of silt accumulation that may be equal to that of Arghandab Reservoir.

Recommendations

This preliminary survey indicates a loss of storage from the two reservoirs of about 470,000 acre-feet at the present time, more than the total initial storage of Arghandab Reservoir. At the present rate of silt accumulation, the reservoirs will probably be half filled with sediment in another 15 years. This will seriously affect the flood-storage capacity of the reservoirs and cause increasing problems for the proposed hydro-power installation at Kajakai Reservoir and for the continued expansion of irrigated lands, especially in the Arghandab-Tarnak area.

It is recommended that a complete survey be made of both reservoirs to more accurately determine the present amount and location of sediment deposits, and to establish a system whereby periodic checks can be made to observe the silt-accumulation rate.

Arghandab Reservoir inflow

Water Year	1,000 Acre-Feet	1,000 cfs Max. daily	1,000 cfs Min. daily
1948	574.0	6.79	0.044
1949	873.0	15.0	.149
1950	1,145	11.8	.243
1951	1,043	11.1	.283
1952	816.4	5.86	.232
1953	493.8	4.79	.071
1954	1,358	13.5	.145
1955	464.1	8.64	.064
1956	1,657	15.5	.136
1957	2,168	22.0	.492
1958	1,119	9.00	.205
1959	1,215	11.9	.280
1960	987.0	9.90	.267
1961	1,134	15.0	.296
1962	539.5	3.02	.117
1963	640.7	6.50	.183
1964	977.1	6.04	.180
Average	1,012 (1,398 cfs)		

Note: 1948-51 record from station below reservoir.
Storage began February 24, 1952.

Maximum discharge 35,700 cfs, March 17, 1957.

Minimum discharge 44 cfs, September 7-8, 1948.

Kajakai Reservoir inflow (Dehraout + Tirin)

Water Year	1,000 Acre-Feet	1,000 cfs Max. daily	1,000 cfs Min. daily
1948	3,885	29.2	1.10
1949	5,193	45.0	1.81
1950	5,256	36.2	1.98
1951	6,171	47.5	2.00
1952	4,827	28.6	1.81
1953	4,156	23.7	1.75
1954	5,523	33.9	2.04
1955	3.796	40.0	1.62
1956	5,952	48.6	2.00
1957	9,059	70.8	2.37
1958	5,549	29.6	2.58
1959	5,003	27.2	2.37
1960	4,735	33.7	2.02
1961	5,135	39.2	2.33
1962	3,175	17.8	1.70
1963	3,301	23.5	1.62
1964	5,155	36.2	1.90

Average 5,051 (6,977 cfs)

Note: 1948-52 record from station below reservoir
Storage began January 28, 1953.

Maximum discharge unknown. Occurred May 3, 1957.

Minimum discharge 1,100 cfs, October 1, 1947
(Start of record - may have been lower prior to that date.)